REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Applicants assert that the present invention is new, non-obvious and useful. Prompt consideration and allowance of the claims is respectfully requested.

Status of Claims

Claims 1-12, 21 and 24-32 are pending in this application and have been rejected.

Claims 1 and 21 have been amended herein. Applicants state that no new matter has been added by these amendments and new claims.

CLAIM REJECTIONS

35 U.S.C. § 101 Rejections

In the Office Action, the Examiner rejected claims 1 and 21, as well as claims 2-12 and 24-32 by their dependency upon claim 1, under 35 U.S.C. § 101 as not falling within one of the four statutory categories of invention.

In response to this rejection, Applicants have amended independent claims 1 and 21 to clarify that the method is in each case performed in a processor. It is respectfully submitted that the amended claims of this application comply fully with the requirements of 35 U.S.C. § 101. Accordingly, Applicants respectfully request that the rejection of claims 1 and 21 under 35 U.S.C. § 101 be withdrawn.

35 U.S.C. § 103 Rejections

In the Office Action, the Examiner rejected claims 1-4, 6-8, 12, 24-27 and 29-32 under 35 U.S.C. § 103(a), as being unpatentable over the combination of Castango et al. (IEEE Vol. 8, No. 5, Sep. 1998, 562-571), Park et al. (U.S. Patent No. 6,535,632) and Trew et al. (U.S. Patent No. 6,173,077). Applicants traverse these rejections in view of the remarks that follow.

According to the Examiner, the combination of Castango et al. and Park et al. does not explicitly teach how to calculate displaced time difference, DFD, and DFD is one of the feature values. In his "Response to Arguments", the Examiner finds no fault in Applicants' previous argument but states that the argument is moot in view of the new grounds of rejection and states that Trew teaches the concept of displaced frame difference. Accordingly, Applicants refer to their previous argument concerning Castagno et al. and Park et al. and confine their argument in this response to the relevance of Trew et al.

Trew does, as the Examiner has correctly noted, teach the concept of displaced frame difference (DFD). The concept of DFD is also disclosed in Trew et al. in the context of the use of motion vectors in image segmentation. However, Applicants argue that any similarity of Trew et al. to the present invention ends there.

In Trew, a DFD value is compared with a threshold (see Figure 3, block 7), and, if the DFD exceeds that threshold, the motion vector for that pixel is regarded as invalid and is disregarded. For such a pixel, an alternate approach to segmentation must be employed.

At column 2, lines 41-44, Trew et al. explain that the method includes the step of "identifying pixels for which the motion vectors are <u>invalid</u> by comparing the predicted and actual pixel values for the next frame" (emphasis supplied). In this context, "comparing the predicted actual pixel values for the next frame" corresponds to calculating the DFD, and it will be seen that the only use of the DFD in Trew et al. is to identify <u>whether or not the motion vectors are valid</u>.

At column 4, lines 24-41, Trew et al. state that there are two categories of pixels for which the predicted segmentation data will be treated as invalid and specifically "the second category are those pixels which are judged as having <u>failed</u> motion compensation" (emphasis supplied).

The teaching of Trew et al. with regard to DFD's is then clear: before using a motion vector in an image segmentation process, check for each pixel whether the DFD exceeds the threshold. If the DFD exceeds that threshold, motion estimation has failed and the motion vector for that pixel is to be disregarded.

If one of ordinary skill in the art were motivated to employ this teaching of Trew et al. in any combination of Castagno and Park, he would simply disregard in Castagno or

Park any motion vector for a pixel, where the DFD exceeds the threshold. However, such use of the teaching of Trew et al. in a combination of Castagno and Park falls outside the scope of the claims of this application.

In the invention as claimed in amended independent claim 1, there is much more than the mere use of DFD. According to amended independent claim 1, a DFD is included as a distance in segmentation vector space, within the step of "determining, using said processor, the membership of a segment for each pixel by the distance in segmentation vector space from the data point representing the pixel to the location of the segment, said distance in segmentation vector space including a displaced frame difference calculated by applying a motion vector from the segment to the pixel". However, as previously argued, the inclusion of DFD as a distance in segmentation vector space looks strange and is counter-intuitive. It remains as strange and as counter-intuitive after consideration of Trew et al.

According to the present invention, the distance between pixels in segmentation vector space (and therefore the probability that those pixels will be grouped in the same segment) includes not only motion vectors but also DFDs. Including DFDs as part of the distance measurement leads to an elegant balancing in the segmentation process of the physical closeness of pixels, the closeness in RGB or other values of the pixels and the similarity of the motion vectors allocated with varying degrees of accuracy at the pixels. In contrast, the good approach of Trew et al. is to use the DFD to decide whether or not to throw away the motion vector.

In summary, even if the combination of Castango et al., Park et al. and Trew et al. as suggested by the Examiner were regarded as an obvious combination, the present invention differs from that combination in (at least) its inclusion of the DFD as a distance in segmentation vector space.

The Examiner contended that one of ordinary skill in the art would have been motivated to provide the segmentation system of the Castagno and Park combination with a DFD as one of the feature values, for the reason that "the DFD is then used to identify where the segmentation predicted by the motion vectors requires correction" (referring to column 3, line 13 of Trew et al.). Applicants respectfully submit that, in order to show that the claimed invention is obvious, the Examiner is required to establish not simply that one

of ordinary skill in the art would have been motivated so use the DFD but also that he would have been motivated to include a DFD in a distance in segmentation vector space. The Examiner's rationale goes only to the first of these two points, and Applicants respectfully argue that the Examiner has not provided any rationale why one of ordinary skill in the art should take the counter- intuitive step of including a DFD in a distance in segmentation vector space.

Additionally, Applicants point out that the passage quoted by the Examiner at column 3, line 13 of Trew et al. must be read in context. The immediately preceding sentence in Trew et al. states that "an excessive DFD may thus indicate that the motion vectors for a particular pixel are invalid". Subsequently, the disclosure (see column 9, line 16 or Trew et al.) makes it clear that the "correction" referred to in the passage quoted by the Examiner consists of abandoning the attempt to make use of motion vectors and instead to employ one or more alternative techniques.

Thus, amended independent claim 1 is now allowable under 35 U.S.C. § 103(a) over the combination of Castango et al., Park et al. and Trew et al. Claims 2-4, 6-8, 12, 24-27 and 29-32 are dependent from amended independent claim 1, and thus include all the limitations of that claim, and are allowable under 35 U.S.C. § 103(a) as well. Applicants respectfully request that the Examiner withdraw all rejections of claims 1-4, 6-8, 12, 24-27 and 29-32 under 35 U.S.C. § 103(a).

The Examiner also rejected claim 5 under 35 U.S.C. 103(a) as being unpatentable over the combination of Castagno, Park, and Trew in view of Aggarwal et al. (U.S. Patent No. 6,728,706), rejected claims 9-11 under 35 U.S.C. 103(a) as being unpatentable over the combination of Castagno, Park, and Trew in view of Price et al. (U.S. Patent No. 5,606,164) and rejected claim 28 under 35 U.S.C. 103(a) as being unpatentable over the combination of Castagno, Park, and Trew in view of Penn (U.S. Patent No. 5,848,198).

In response, Applicants point out that claims 5, 9-11 and 28 are dependent on claim 1. As discussed above, claim 1 is patentable over the combination of Castango et al., Park et al. and Trew et al. None of Aggarwal et al., Price or Penn solves the deficiencies of those references, as discussed above, such that claim 5 is patentable over the combination of those references even in view of Aggarwal et al., such that claims 9-11 are patentable over the

combination of those references even in view of Price et al. and such that claim 28 is patentable over the combination of those references even in view of Penn. Applicants respectfully request that the Examiner withdraw these rejections.

The Examiner also rejected claim 21 under 35 U.S.C. 103(a) as being unpatentable over the combination of Castagno, Park, and Min et al. (International Conference on Pattern Recognition, Vol. 1, Sep. 3-7, 2000, pp. 644-647). Applicants traverse this rejection in view of the remarks that follow.

According to the Examiner, Castango et al. suggest motion and position as features of segmentation vector space but do not explicitly teach that distance can be used as membership measurement in the segmentation vector space or that the data can be in a toroidal space. In his "Response to Arguments", the Examiner finds no fault in Applicants' previous argument but states that Applicant's argument is moot in view of the new grounds of rejection and comments that the Min reference now teaches the concept of toroidal space segmentation. Accordingly, Applicants refer to their previous argument concerning Castagno et al. and Park et al. and confine their argument in this response on the teaching of Min.

The primary teaching of Min is that where images comprise representations of curved objects then algorithms which attempt to segment region of the image (which are necessarily planar) may be improved if those planar regions are treated as projections of curved surfaces. Thus, with reference to Figure 2 of Min, an algorithm which attempts to separate from the remainder of the image the roughly triangular object may be improved if the planar triangular region were treated as a projection of a conical surface.

However, this is not relevant to the invention recited in claim 21. Amended independent claim 21 requires the step of "representing the image data as points in a segmentation vector space which is the product of the vector space of feature values and the vector space of pixel addresses, said segmentation vector space having a canvas which is toroidal". According to amended independent claim 21, a segmentation vector space is defined which is the product of the vector space for feature values and the vector space of pixel addresses.

Segments are then defined in that segmentation vector space. In order to avoid a problem of the disappearance or reappearance of objects because of global motion in the scene, the invention of claim 21 provides that the segmentation vector space has a toroidal canvas. It is the canvas of the vector space that has the toroidal shape. However, this has nothing to do with the shape of any object in the image or of any segment.

Moreover, the segments as defined in the present invention are themselves very different from the curved surfaces suggested in Min. In Min, it is regions of pixel that are regarded as representing surfaces, which may in turn be curved. In the present invention, the multidimensional segmentation space includes not only the locations of pixels in the plane of the image but also feature values at the pixel, such as RGB or motion vector values. The simple relationship between a planar region of the image, which might be regarded as depicting a curved surface in a real world object, does not therefore apply in this multidimensional space.

It is accordingly submitted that, even if the teaching of Min were to be combined included with Castagno and Park, although it is difficult to understand what form such a combination might take, this combination would still be lacking the feature of a vector space with a toroidal canvas. Accordingly, amended independent claim 21 is now allowable under 35 U.S.C. § 103(a) over the combination of Castango et al., Park et al. and Min.

In view of the foregoing amendments and remarks, the pending claims are deemed to be allowable. Their favorable reconsideration and allowance is respectfully requested.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 50-3355.

Respectfully submitted,

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